American Black Bears (*Ursus americanus*) in Saguaro National Park: Status and population estimate using genetic analysis

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INTRODUCTION

The American black bear (*Ursus americanus*) ranges widely throughout North America in a variety of habitats including woodlands, pinyon-juniper and conifer forests, and chaparral. Black bears were historically common in all forested areas of the continent, but their range has been reduced by over 60%, probably due to hunting, habitat destruction, and habitat fragmentation (Varas 2007, Miller 1990).

Although they are not strongly associated with the American Southwest by the public, black bears are found in almost every high altitude Sonoran Desert mountain ecosystem. Arizona has an estimated population size of 2,500-3,500 black bears (Cunningham et al. 2001, McCracken et al. 1995), although the species' range has been reduced to isolated populations in the southeastern and central areas of the state (Waddell and Brown 1984, Hoffmeister 1986). Along with grizzly bears (extinct in southern Arizona for nearly a century), American black bears once occurred in both mountains and low elevation riparian areas, such as along the Santa Cruz River that flows through downtown Tucson (Hoffmeister 1986). Now, they are observed mainly within the Santa Catalina and Rincon Mountains and other "Sky Islands" mountain ranges, although individuals sometimes come down into desert areas now within the city of Tucson (e.g., Scarpinato 2005). Concerns for black bears in Arizona include overhunting, land use change and loss of population connectivity (Varas et al. 2007).

In the Rincon Mountain District of Saguaro National Park, black bears were rarely reported between the early 1900's through the 1970's (Sumner 1951, Davis and Sidner 1992). In the last 3 decades, however, their numbers seem to have increased, possibly due to relaxed hunting pressure, changes in fire management regimes, increase in forage plants, or natural population fluctuations (Swann and Powell 2006). Infrared-triggered camera traps set in the park

above 6500 ft (1980 m) during a mammal inventory of the park 1999-2005 regularly captured images of black bears, and staff and visitor reports of bear observations and sign, such as scat, scratch trees, or tracks, have increased significantly in the last 20 years (Swann and Powell 2006, Swann in press).

Although it appears that the population of black bears in the Rincon Mountains is rebounding from previous decline, there is no quantitative information on this species in the park. Because American black bears are of great interest to visitors, and because their activities can impact visitors and park staff, especially in backcountry campgrounds, understanding more about this species is important for the park. In addition, estimating their population size and determining their distribution within Saguaro National Park can be helpful in effectively managing bear populations to ensure the long-term preservation of this species.

Using DNA to estimate abundance. Estimating population size (abundance) with a reasonable amount of precision can be difficult in large mammals such as black bears due to their secretive nature and relatively low densities (Mowat and Strobeck 2000). Wildlife researchers use various techniques such as ear tags, neck collars, radio transmitters, and natural markings to identify and track individual animals to estimate abundance, but each of these methods has limitations (Woods *et al*. 1999). Most methods for bears involve capturing live animals for radio telemetry or marking (Mace et al. 1994, Miller et al. 1997), which is both invasive and expensive.

DNA analysis provides a viable alternative that is inexpensive, permanent, and requires little or no contact with the species of study. Recent advances in molecular biology have led to an increase of studies applying genetic techniques to diverse fields such as ecology, evolution, behavior, and conservation (Fernando *et al.* 2003). In addition to being present in living tissue,

DNA also occurs in a variety of shed tissues such as scat, shed hairs, feathers, skin, and eggshells (Fernando *et al*. 2003; Kohn and Wayne 1997) that can be collected with less skill, time, and money than collecting blood and/or biopsy samples. Samples from black bears, for example, can be obtained non-invasively from feces (scat) or hair samples left on scratch trees. Genomic DNA is contained within either the roots of the animal's hair or in the epithelial (sloughed intestinal lining) cells on the surface of the animal's scats (Wasser *et al.* 1997, Albaugh *et al.* 1992). After these tissues are collected, small amounts of DNA isolated from them can be subjected to polymerase chain reaction (PCR), an enzymatic process by which a specific region of DNA is replicated repeatedly to yield several million copies of a particular sequence (Taberlet *et al.* 1996). PCR can provide large enough quantities of DNA for detailed biological studies. Mitochondrial DNA (mtDNA) and Y-chromosome typing can be used to confirm what species the tissue came from, and what the sex of that species is.

In addition, individual animals can be identified using highly-variable microsatellite loci, similar to DNA-fingerprinting used in human crime labs (Woods et al. 1999, Kohn et al. 1999). These data on individuals can be used with existing methods such as mark-recapture methods (Woods et al. 1999, Mowat and Strobeck 2000) or rarefaction curves (Kohn et al. 1999) to estimate abundance. After each scat and hair collected in an area is assigned to an individual, population size is estimated based on the number of unique multilocus genotypes relative to the total number of samples analyzed (Kohn *et al.* 1999).

There are many advantages of using genetics to study wildlife beyond the fact that samples can be collected non-invasively. First, data from individual animals identified and sexed through DNA can provide a "snapshot" of the population if samples are collected within relatively short time frame, providing information on rates of mortality, birth, immigration, or

emigration (Seber 1982). In addition, genotyping can provide estimates of genetic variation within a population, sex ratios, abundance, and distribution of individuals, and can allow inferences on animal movements, home range, habitat, and resource use (Wasser *et al.*2004).

However, studying wildlife using DNA obtained non-invasively has drawbacks. An important consideration is that the small amounts of genetic material in scat (Goosen *et al.* 1998) can degrade as they are exposed to sun and other environmental elements (Bellemain *et al.* 2005). Thus, many samples that are collected cannot be genotyped, and allelic dropout or false alleles may sometimes lead to incorrect results (Murphy *et al.*2002, McKelvey and Schwartz 2004). In addition, sound analytical techniques are important for ensuring that individual identifications are based on adequate data so that false matches (when 2 samples are identified as the same individual, by chance, rather that because they are actually the same individual) and false identification (where one of the 2 alleles of heterozygous individual fails to amplify in a degraded or low quantity DNA sample [Eggert *et al*. 2003]) do not occur.

With these considerations in mind, Saguaro National Park initiated a collaborative study with the University of Arizona in 2005 to evaluate whether or not genetic material collected using non-invasive techniques could be used to estimate abundance, sex ratios, and the distribution of black bears in the Rincon Mountains. Specifically, we collected black bear scat and hair samples and extracted DNA from these samples to identify individuals. In addition, we recorded location and dates of all collections as well as of other bear sign such as tracks, and used infrared-triggered wildlife cameras to obtain photographs of black bears. We used these data to map distribution of bears, estimate population size, document interactions between people and bears, and increase awareness of bears by park visitors and staff.

MATERIALS AND METHODS

Study Area. This study took place in the Rincon Mountain (east) District of Saguaro National Park located east of Tucson, Arizona (Figure 1). The Rincon Mountain District is composed of 60,000 acres (~93.75 square miles, or 242 km^2) of wilderness and ranges from 2670 ft to 8666 feet (814 – 2641 m) in elevation. The wilderness is composed of 6 biotic communities: desert-scrub, desert grassland, oak woodland, pine oak woodland, pine forest, and mixed conifer forest. Saguaro National Park contains a great diversity of wildlife due to its biological communities and the fact that the park is adjacent to major biogeographic provinces such as the Rocky Mountains to the north, the Sonoran Desert to the west, the Madrean Mountains in Mexico to the south, and the Chihuahuan Desert to the east (Swann et al. 2005). Of the more than 66 species of mammals documented in the Rincon Mountain District of the park (Swann and Powell 2006), the black bear is the largest species. Genetic samples obtained during this study were gathered during a 3-year period from 2005 to 2008, with most samples collected in summer and fall of 2005.

Collection and Preservation Methods. The primary field work consisted of walking of transects to look for and collect scat and hair samples. Large carnivores often defecate along trails and territorial boundaries (Kohn *et al.* 1999), so we looked for sign while walking along designated trails and obvious wildlife (bear) trails in upland and riparian areas, mostly (but not exclusively) in woodland and forest communities above 5000 feet (1524 m) in elevation. Transects were not randomly located; rather we tried to cover as many areas of the Rincon Mountain District as possible. Black bear hairs are often associated with trees (as well as human-built signs and other structures) that are scratched by bears. These trees are quite often located along trails and at trail junctions and their bark is often obviously scratched by large claws. In

addition, bear trees often have small branches that have been shredded or damaged. When we found these trees, we examined them closely for bear hair (Figure 2). Black bear scats (Figure 3) are usually obvious and distinctive, being generally round and about 2 inches (5 cm) in diameter), segmented, deposited in large piles about 6-8 inches (15-20 cm) long and 3-4 inches (8-10 cm) high, and normally containing plant and/or insect material (LeCount 1986).

For each sample collected, we recorded the following information: GPS location in UTMs (datum NAD 83), date, photo number, scat dimensions, color and age, and collector name. Scat was collected by the technician wearing latex gloves and placed in a paper bag, then stored in a cooler for transportation to Tucson. Hairs were collected using tweezers (Figure 2) and stored in a small vial. After arriving at the park headquarters or the University of Arizona, scat samples were stored in frozen (-20˚ C) until the DNA extraction process.

DNA Extraction. DNA was extracted from scat and hair following different protocols. For scats, the surface was scraped to obtain epithelial cells, this scraped material was collected into tubes and approximately 0.40 - 0.60 g was subsampled for each extraction. The QIAmp® Stool Mini Kit (Qiagen Inc., Valencia, CA) was used following the manufacturer's protocol for isolation of DNA from stool. The final step (eluting the DNA) included adding 50µl of buffer AE to the Qiagen column, centrifuging, washing with 50µl of H_2O, and centrifuging once more giving a final volume of 100µl od DNA. For each batch of scat DNA extractions, one sample of water (instead of scat scrapings), was included for a contamination check.

For hair DNA extractions, 3-6 hair roots were trimmed from the hair shaft and placed into a 2 ml tube. Buffer XI (10 mM TrisCl pH 8, 10 mM EDTA, 100 mM NaCl, 250 µl/ml Proteinase K. 40 mM DTT, 2% SDS) was added to each tube and hair roots cells were allowed to lyse overnight at 55˚ C. Thereafter, the QIAmp® Dneasy Tissue Kit (Qiagen Inc., Valencia, CA) was

used following the manufacturer's protocol for isolation of genomic DNA from tissues. The final step (eluting the DNA) and the contamination check were performed as with the scat DNA extractions. All extractions occurred in a room dedicated to processing samples with very low DNA yield, located in a separate building from where any animal DNA or PCR work occurs to avoid contamination.

Genotyping for Individual Identification. The extracted DNA was amplified using the 8 black bear specific microsatellite DNA loci: G10L, G10M, G1A, G1D, G10J, G10O, CXX20, and Mu50 (Woods et al. 1999; Paetkau et al. 1998). Each PCR amplification, for each microsatellite locus, was performed 3 times for each sample to control for allelic dropout – a common error in low DNA yield samples. The PCR products were analyzed using fluorescence fragment analysis technology (ABI 3100, DNA sequencher; Applied Biosystems, Foster City, CA). Genotyper 1.0 (Applied Biosystems) software was used to detect alleles and genotype the PCR products.

To estimate population sizes, we used rarefaction analysis, a recent methodological model that has been used to estimate abundance using microsatellite genotypes in DNA obtained from scat and hair. In this model the population size corresponds to the projected asymptote of a function (the rarefaction curve). This curve is generated from the number of DNA samples analyzed versus the cumulative number of unique genotypes. Two possible equations suggested for a rarefaction analysis are (1) Kohn's: $y = ax / (b + x)$ (Kohn *et al.* 1999) and (2) Eggert's: $y = a\,(1 - e^{(bx)})$ (Eggert *et al*. 2003). In both equations y = cumulative number of genotypes, x = number of genotyped DNA samples, a = asymptote which is the population estimate, and b = non-linear slope of the function (Frantz and Roper 2006). Both of these equations are often simultaneously used to derive a population size estimate.

Other data. To increase our knowledge of black bears in Saguaro National Park, we summarized historic and contemporary data, including wildlife reports to the park and visitor and staff observations. As part of this study and a long-term study of mammals at the park using infrared-triggered wildlife cameras (Swann and Powell 2006, Swann *in press*), we set wildlife cameras along game trails believed to be used by black bears. In addition, we requested that researchers and park staff working in the Rincon Mountain District keep records on bear sign that they observed during their activities, such as leopard frog surveys or hiking to Manning Camp. While searching for bear scat and hair for DNA analysis, we also looked for and documented locations of other bear sign such as tracks (Figure 3), rolled rocks, logs or stumps torn apart, chewed signs, and bedding areas.

RESULTS

Abundance. We collected approximately 186 samples (34 hair, 152 scat) during 2005-2008. A number of samples were discarded because they were clearly degraded (Figure 4); of the 105 samples we attempted to extract DNA from, we extracted DNA from 78 samples, 73 samples of which were identified through mtDNA analysis as being black bear (we inadvertently collected some scats of coatis, mountain lions, and canids). Of these 73 samples (Appendix A), 23 samples produced at least 4 alleles, and only 11 worked with at least 7 alleles. The number of microsatellite alleles per locus ranged from 1-8. Using 23 samples with 4 alleles, we estimated the number of black bears in the Rincons to be 20 individuals with a 95% confidence interval of 15-25 bears. Using the more conservative sample of 11 with at least 7 alleles, we estimate the population to be 12 bears with a 95% confidence interval of 8-16 bears.

Distribution. Hair and scat samples were collected throughout the Rincon Mountain District (Figure 5) ranging in elevation from 4100 feet (1249 m) to over 8000 ft (2438 m). In addition, bear tracks were observed and documented at elevations as low 4200 feet (1280 m) during this study.

During 2004-2006, the years of this study, we obtained 15 photographs of black bears at 6 locations. When data from the entire period 1999-2008 is included we obtained 40 photographs of black bears from16 locations (Figure 6). Bears were photographed over a wide range of elevations from as low as 3143 feet (958 m) west of the Loop Road to over 8400 feet (2560 m) on the north slope of Mica Mountain. If observations by biologists and staff are included, bears are clearly well-distributed in the Rincons, including in desert areas. However, the great majority of observations, scat, sign, and photographs of black bears are from above 6000 feet (1828 m) n elevation. Bear sign in the Rincons is concentrated in forested areas including Mica Mountain, Heartbreak Ridge, Happy Valley Saddle, and Rincon Peak (Figure 5), although Rincon and Tanque Verde Peaks were under-sampled in this study relative to other sites.

Additional information. During this study, bears were periodically observed by biologists and Saguaro National Park staff. Todd Nelson, the park's Manning Camp back-country ranger, collected a large number of samples for this study and wrote of his experiences in a story called "In Search of Bear Scat," published in **Oh Ranger: True Stories from our National Parks**, a book of stories by National Park Service rangers (Figure 10; Appendix B). It is noteworthy that a number of the very fresh scats Todd collected on the day described in his story (August 21, 2005) produced high-quality DNA, and 3 individual bears were identified. Confirming the wide range of this species in the park, a credible observation of a black bear was reported in January 2010 by a visitor on the Cactus Forest Loop near Javelina Rocks.

During this study, Saguaro National Park developed and implemented a management plan for mountain lions and black bears based on data from this study and experiences of other national parks (Appendix C). The park increased its effort in educating the public and, especially, visitors and park staff who camp in the back-country.

DISCUSSION

Black bears are one of North America's most well-known charismatic animals and are of significant economic and social value to hunters, wildlife viewers, and all who enjoy the outdoors. Although they are increasingly found in suburban areas in the east, they remain symbols of wilderness and national parks and forests. "Smokey the Bear" is a black bear, as are "Teddy" bears. The presence of black bears in the Rincon Mountain District of Saguaro National Park and other Sky Island mountain ranges in Arizona is often used as an example of our biological diversity and of the great value of the high elevation areas that rise above the saguaros and other Sonoran Desert plants. This study was the first comprehensive study of this species in Saguaro National Park, and provided the park with both an estimate of the number of bears in the park and a wealth of other information on this species.

Abundance. We estimated that approximately 12 black bears occurred in Saguaro National Park during the 2005-2008 period, with a range of 8-16 bears. This population size, in comparison with similar areas, suggests that the park has a healthy black bear population. Male Black bears typically have a home range of about 31 mi^2 (81 km^2), which typically encompasses 7-15 female home ranges; male home ranges overlap, but the males compete within them (Rogers 1999). The Rincon Mountain District is approximately 94 mi^2 (242 km^2) and might be

expected to contain several adult male black bears as well as number of females and juveniles. Black bears can live approximately 30 years (Rogers 1999).

Distribution. Black bears are highly adaptable, and their habitat in Arizona is more varied than most people realize. In our study, most bear sign was found in forested habitat. Indeed, black bear scratch trees, scat, tracks, trails, and other sign can be readily found throughout most high elevation areas of the Rincons, often on the same trails used by hikers. However, black bears clearly use lower elevation areas, at least seasonally. We found high concentrations of bear sign, and photographed bears, at approximately 4500 feet elevation in the Mesquite Flats area between Madrona Ranger Station and Grass Shack. This area was used in September and October, and has a high abundance of prickly pear, which black bears are known to eat (Hoffmeister 1986). Black bears are seen periodically by visitors on the Loop Road, and scat containing saguaro seeds have also been reported by park staff (D. Foster, personal communication). Davis and Sidner (1991) reported a black bear that was seen at the watering hole at the Visitor Center.

Young black bears, especially males, leave their mother's territories after 1-2 years and travel to other areas. It seems likely that some bears observed in Tucson, Sierra Vista, and other cities are young males travelling to new areas to establish territories. Corridors for travelling among mountain ranges thus also seem to be important habitat component for this species in the Sky Island area.

Varas et al. (2007) indicated that black bears from Arizona were more closely related to black bears in western New Mexico and along the Rocky Mountains than to bears in California, which likely represents historical distribution since glacial times. Black bears in Sky Island mountain ranges such as the Rincons are closely related to bears in the Sierra Madre Occidental

in northern Mexico. Varas et al. (2007) also found evidence that black bears are moving among the Sky Islands in southern Arizona, as well as between mountain ranges in the U.S. and Mexico.

History. Hoffmeister (1986) summarizes the history of both black bears and grizzly bears in southern Arizona. Both species were found in both mountainous and riparian areas prior to the settlement by Spanish and English-speaking settlers, and both species were hunted heavily in the 19th and early 20th century. Beginning in 1915, the United States government initiated a predator control in Arizona through the U.S. Biological Survey (Robinson 2005).

The last grizzly bear in southern Arizona appears to have been killed in what is now Saguaro National Park in the early 1920s, following a report by M. E. Musgrave of a grizzly roaming in the Rincons in June 1921 (cited in Davis and Sidner 1992). According to Ollie Barney, an accomplished hunter who grew up on the Barney Ranch in Happy Valley, this bear was killed by A. B. Carey, a rancher who was friendly with Barney and his father. In an interview with Don Swann in 2006, Barney stated that Carey trapped this last grizzly at a spring near the top of Wrong Mountain, then shot it. Barney believed that this occurred in 1921. A skull of a bear from the Rincons, possibly this grizzly, was once in the collection of the Arizona Historical Society, but is now lost. The last grizzly bear in Arizona was killed in 1935 (Hoffmeister 1986).

Although black bears were not specifically targeted by the Biological Survey unless they were implicated in killing livestock, black bears were heavily hunted, inadvertently poisoned in attempts to kill other predators (Robinson 2005), and were classified as a predatory (and controlled) species in Arizona during the 1920s and 1940s (Arizona Game and Fish website, http://www.azgfd.gov/h_f/game_bear.shtml). Hoffmeister (1986) believed that black bears were already in low numbers in the early 1900s, but cites sources from southeastern Arizona who

believed that the species was nearly extirpated by the 1950s due to predator control. In Saguaro National Park, black bears were always listed in park annual wildlife reports beginning in 1939, but the reports of the 1940s commented on the rarity of the species. In a comprehensive mammal survey of the Rincons, Sumner (1951) could not find any evidence that bears occurred in the park. Indeed, in the 1970s, discussion of potential reintroduction of bears into Saguaro National Park occurred between the National Park Service and the Arizona Game and Fish Department (Unpublished NPS records, Western Archeological Conservation Center). In their inventory of mammals of the high country of the Rincons, Davis and Sidner (1992) found no evidence that bears occurred in the park at that time. However, they did report on 11 observations of bears between 1964 and 1990, including several at Manning Camp.

If bears were indeed once rare or occasional residents of the Rincons, it is interesting to speculate as to why they are relatively common now. Contributing factors may include the release from predator control and increased management of black bears by the Arizona Game and Fish Department, which include permit-only spring season in some game management units, elimination of bear-baiting, and unit harvest limits where the season is closed after a certain number of females are taken (http://www.azgfd.gov/h_f/game_bear.shtml).

Management and Conservation. Saguaro National Park has responded to increases in the number of black bears in the park in the past decade, following several widely–separated incidents of bears raiding food caches. More importantly, in the late 1990s there was an increase in interactions between bears and humans in the Santa Catalina Mountains, including the mauling of a young camper. Although no major incidents have occurred in Saguaro National Park, Davis and Sidner (1992) discuss bear problems at Manning Camp during 1989 and 1990, when a large black bear opened a food locker, overturned garbage cans, and chewed up some

equipment. They emphasized that removing a problem black bear from the high country of the Rincons would be a major undertaking and encouraged the park to bear-proof the cabin area, offering that "prevention is far easier than the cure." During the past decade the park has placed metal bear boxes in all campsites (Figure 8), and in 2007 developed and began implementation of a Mountain Lion and Black Bear Management Plan (Appendix C). The plan includes educational, maintenance, response, and monitoring components.

Although the population of black bears in Saguaro National Park appears to be healthy at the present time, and larger than it has been at the past, this species will always be somewhat sensitive in the park due to its large home range requirements. Genetic evidence from this study clearly indicates that black bears in the Rincons are closely related to bears in the Santa Catalina, Santa Rita, Huachua, and other nearby mountain ranges. Based on this work and other samples from throughout the Sky Islands and northern Mexico (Varas 2007) maintaining this connectivity between mountain ranges is vital. Although movement between the Santa Catalinas and the Rincons is relatively unrestricted due to protected NPS and National Forest land, connectivity between the Rincons and other mountain ranges is limited and becoming more so (Figure 11). In particular, development along the Interstate 10 corridor, and the highway itself, is becoming more of a barrier for bears moving to and from the Santa Rita and Whetstone Mountains. Movement to the Galliauro Mountains to the east is still fairly open, but this could be threatened by future development along the San Pedro River corridor. Keeping the San Pedro River valley and Las Cienegas areas open for large animal movements is probably key to the future survival of American black bears and other large mammals in the park.

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Table 1. Results of DNA analysis of black bear scat and hair in Rincon Mountain District, Saguaro National Park, 2005-2008.

Samples collected	Positive bear (mtDNA)	Good quality samples	High quality samples	Population estimate	Population estimate range
186	73	34	11	12	8-12

Figure 1. Location map of Saguaro National Park within Tucson, Arizona. Black bears are not recorded from the Tucson Mountain District (west of Tucson, on left). This study took place in the Rincon Mountain District (east of Tucson, on right).

Figure 2. Left: UA Conservation Biology intern, Jose Camerena, collects bear hair for DNA analysis from a ponderosa pine "scratch tree" near Helen's Dome, Rincon Mountains. Right: black bear hair embedded in pine bark.

Figure 3. Upper left: Black bear scat near Grass Shack campground, 23 September 2005. Lower left: Black bear tracks in Chimenea Canyon, 22 September 2005. Right: Jose Camerena collects data on a mountain lion skull found near Happy Valley campsite, 8 June 2006.

Figure 4. Some bear scat collected was highly weathered, so that DNA was too degraded and not high enough quality for analysis.

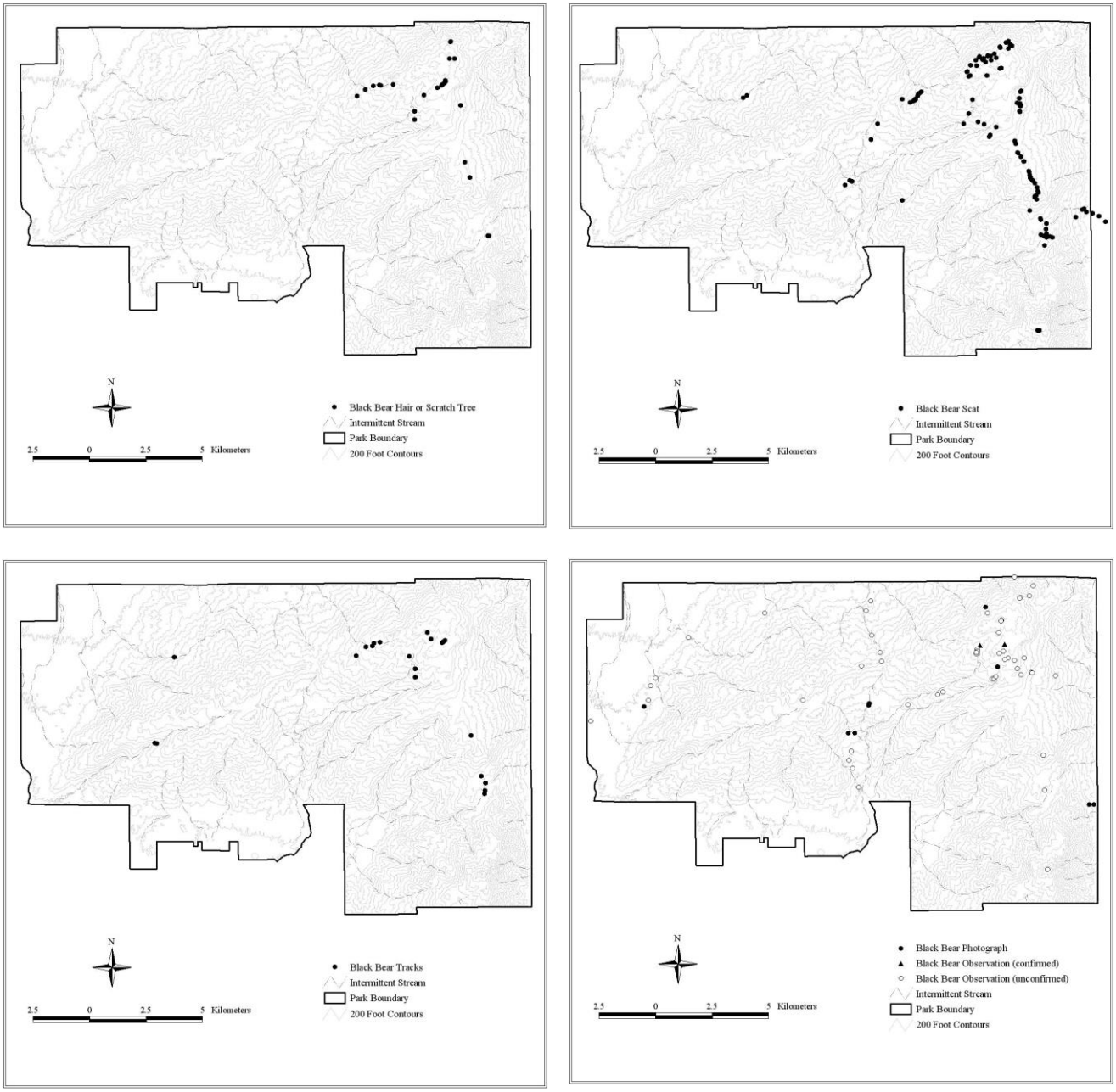

Figure 5. Distribution of observations of black bears and their sign in Saguaro National Park, Rincon Mountain District. Upper left: hairs collected and scratch trees. Upper right: Scat collected. Lower left: Tracks observed and photographed. Lower right: Photographs of black bears during 1999-2008, and observations by biologists (confirmed) and park visitors and staff (unconfirmed) during 1990-2008.

Figure 6. Black bear photos from infrared-triggered wildlife cameras. Upper left: Happy Valley campsite, May 2006. Upper right: near Grass Shack, May 2004. Lower left: Heartbreak Ridge near Happy Valley lookout, November 2004. Lower right: Near Chimenea Creek, October 2001.

Figure 7. Black bears are sometimes seen by Saguaro staff, especially in forested areas. Here, the trail crew's work is interrupted by a black bear walking on the North Slope trail in 2007. Photo by Evonne Ellis.

Figure 8. Black bear cub observed by Todd Nelson approximately ¼ mile west of Italian Spring on 31 July 2002.

Figure 8. Bear box in Happy Valley campsite. All campsites in the park are equipped with bear boxes for campers to store food in. During this study, the park developed and implemented a black bear management plan, and the park's fire, trail, and other crews are trained to be bear-conscious and to be careful about storing food when working in the field.

Bear in park puts cops in frenzy

Police attempts to capture the creature involved dozens of officers chasing it with lights flashing and sirens wailing, causing it to panic.

Photos by James S. Wood / Arizona Daily Star

300-pounder wanders into Udall area — but that's not so strange

By Daniel Scarpinato
ARIZONA DAILY STAR

The appearance of a cinnamon-colored North American black bear in Udall Park on Wednesday wasn't an extraordinary occurrence, officials say.

But the multiagency pursuit to capture it was unconventional. Dozens of police officers converged on the park, chasing the bear in vehicles with lights flashing and sirens wailing, forcing it into nearby neighborhoods, where it knocked down a wall before two tranquilizer darts caused it to collapse into a swimming pool.

Though more than 500 people were at the park at the time, no one was injured and the bear was recovering in the custody of the Arizona Game and Fish Department.

The incident caused several hours of commotion, but it wasn't that unusual, officials say. There have been at least seven reported bear sightings in the Tucson area in the past few years.

"They come in and out of our town with some frequency," said Hans Koenig, field supervisor for Arizona Game and Fish in Tucson. But, in most cases, a coordinated effort to

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Dave Neill of the Game and Fish Department shows the tranquilized bear in its cage. The creature was resting comfortably Wednesday.

Figure 9. Arizona Daily Star article on bear, presumably from the Rincons or Santa Catalina Mountains, that visited Udall Park on Tucson's east side in 2005. The article noted that it was "not so strange" to see a bear in the city. Black bears were once found along the Santa Cruz River in downtown Tucson and are presumed to cross desert areas between mountain ranges, as well as to periodically forage in the desert on prickly bear fruit, mesquite beans, and other foods.

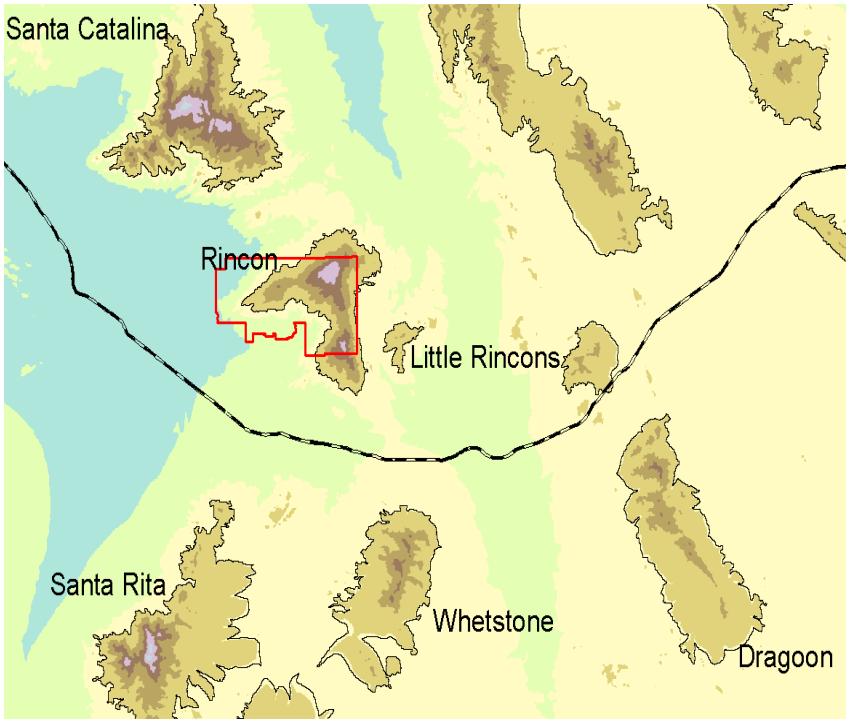

Figure 10. The Rincon Mountain District of Saguaro National Park (outlined in red) within the context of nearby "Sky Island" mountain ranges. Genetic evidence from this study and Vargas et al. (2007) indicates that black bear populations in the Sky Islands are well-connected, and that individual bears move among the Rincon, Santa Catalina, Whetstone, Santa Ritas, and other mountain ranges. However, there is some suggestion that movement across the Interstate 1-10 corridor is becoming restricted.